

FLIGHT PLAN NOTES

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A. FLIGHT DESCRIPTION

Orbiter: OV-104 Atlantis
 Launch Window: 10 minutes
 Inclination: 51.6°
 Insertion / Rndz Altitude: 122 / 190 nautical miles
 Duration: 11 + 1 + 2 days

B. SHUTTLE CREW

CDR – Steve Lindsey	MS3 – Stephanie Wilson
PLT – Mark Kelly	MS4 – Piers Sellers (EV2)
MS1 – Mike Fossum (EV1)	MS5 – Thomas Reiter (ISS UP Augmentation)
MS2 – Lisa Nowak	

C. MAJOR EVENTS

<u>EVENT</u>	<u>FD</u>	<u>MET</u>	<u>DATE</u>	<u>CDT</u>	<u>GMT</u>
Launch	1	0/00:00	Mon Nov 15	03:09 PM	320/21:09
OBSS Survey	2	0/18:00	Tue Nov 16	09:09 AM	321/15:10
Ti	3	1/17:03	Wed Nov 17	08:12 AM	322/14:12
DOCK	3	1/19:49	Wed Nov 17	10:58 AM	322/16:59
OBSS Handoff	3	2/23:55	Wed Nov 17	03:04 PM	322/21:05
MPLM Installed on ISS	4	2/17:45	Thu Nov 18	08:54 AM	323/14:55
MPLM Ingress	4	2/23:15	Thu Nov 18	02:24 PM	323/20:24
EVA #1	5	3/18:00	Fri Nov 19	09:09 AM	324/15:09
Crew Conference	6	4/21:20	Sat Nov 20	12:29 PM	325/18:29
EVA #2	7	5/18:00	Sun Nov 21	09:09 AM	326/15:09
MPLM Egress	9	7/14:55	Tue Nov 23	06:04 AM	328/12:04
MPLM Berthed in Shuttle	9	7/21:05	Tue Nov 23	12:14 PM	328/18:15
OBSS Berthed in Shuttle	9	8/00:35	Tue Nov 23	03:44 PM	328/21:44
ISS Egress	10	8/15:15	Wed Nov 24	06:24 AM	329/12:24
Undock	10	8/17:46	Wed Nov 24	08:55 AM	329/14:55
D/O TIG KSC 172	12	10/18:45	Fri Nov 26	09:54 AM	331/15:55

D. LANDING OPPORTUNITIES

		<u>Landing</u>	<u>Site</u>	<u>CST</u>	<u>MET</u>
		<u>Orbit</u>			
Nominal	Primary	172	KSC	Fri Nov 26/10:57 AM	10/19:48
	1 Rev Late	173	KSC	Fri Nov 26/12:33 PM	10/21:24
EOM +1	Primary	187	KSC	Sat Nov 27/09:48 AM	11/18:39
	1 Rev Late	188	KSC	Sat Nov 27/11:23 AM	11/20:14
EOM +2	Primary	203	KSC	Sun Nov 28/10:14 AM	12/19:05
	1 Rev Late	204	KSC	Sun Nov 28/11:49 AM	12/20:40

E. COMMUNICATIONS

The Summary Timeline contains several data bands for ground site and TDRS events. The TDRS band reflects the three prime TDRS satellites that will be used for orbiter coverage (East, West, and Z) and their longitudinal positions. Ku-band coverage is shown as unshaded bars.

TDRS-Z currently does not have the capability for DTV, therefore can not be used for critical damage detection. Nor is TDRS-Z considered acceptable for PAO events. OCA downlink is limited to 2 Mbps on TDRS-Z.

Prime TDRS Support: TDRS 47(LON: - 47° W), TDRS 171(LON: -171° W),
TDRS 275(LON -275° W)

Backup TDRS Support: TDRS 41 (LON: -41° W), TDRS 174(LON: -174° W)

U.S. Ground Sites: MIL, DFR, WLP

F. MAJOR PAYLOADS

1. UTILITY LOGISTICS FLIGHT 1.1 (ULF1.1) LAUNCH PACKAGE (LP)

The Utilization and Logistics Flight 1.1 (ULF 1.1) LP consists of the MPLM, the ICC with Orbital Replacement Units (ORUs), the LMC, two Assembly Power Converter Units (APCUs), Micro-Electro-Mechanical System (MEMs)-based Pico Satellite Inspector (MEPSI) and ISSP equipment, supplies, four ISSP Utilization payloads, and crew augmentation equipment in the Orbiter crew compartment.

The MPLM CE Flight Module-1 (FM-1) is a pressurized module that will carry to orbit three Resupply Stowage Racks (RSRs), five Resupply Stowage Platforms (RSPs) and three International Standard Payload Racks (ISPRs), which include the two Expedited Processing of Experiments to the Space Station (EXPRESS) Transportation Racks (ETRs), and Minus Eighty-Degree/Laboratory Freezer for ISS (MELFI). Reference NSTS 21499 for a description and figures of the MPLM configuration.

The ISSP middeck Utilization payloads and payload hardware for launch and transfer to the ISS are:

- a. Human Research Facility (HRF) Renal Stone
- b. European Modular Cultivation System (EMCS) experiment containers
- c. Passive Observation for Experimental Microbial Systems (POEMS)

1. 10 containers

d. Fungal infections, Immunity, Tumors (FIT)

The ICC CE consists of the Unpressurized Cargo Pallet (UCP) and the Keel Yoke Assembly (KYA). The ICC will be used to transport the Early Ammonia Thermal Control (EATC) Pump Module (PM) assembly, DC-to-DC Converter Unit (DDCU) Cold Plate (CP), the Main Bus Switching Unit (MBSU) CP, and two Fixed Grapple Bars (FGBs). The EATC PM will be installed on the ICC using a Flight Releasable Attachment Mechanism (FRAM), the DDCU and MBSU CPs will be installed in a deployable Spacehab Oceaneering Space Systems (SHOSS) box Extended-height Deployable (ED) with an Adjustable Grapple Bar (AGB) attached and the two FGBs will be installed on the FGB Flight Support Equipment (FSE) attached to the ICC. Refer to the ICC CIP Addendum for STS-121 for figures of the launch/return configurations.

The LMC is a cross-bay carrier located in bay 13. The launch configuration includes the hardware required to perform Development Test Objective (DTO) 848, Orbiter Thermal Protection System (TPS) Repair Techniques during an Extravehicular Activity (EVA). Refer to the LMC CIP Addendum for STS-121 for figures of the LMC launch/return configuration.

ISS items will be carried in the Orbiter crew compartment, including EVA tools and equipment, crew augmentation gear, ISSP middeck Utilization payloads and other ISS mission-unique support hardware.

MEPSI consists of a launcher that contains a set of two small deployable satellites, referred to as Pico Satellites (PICOSATS). The launcher is mounted to an adaptive payload carrier mounted on the starboard side of the payload bay. The PICOSATs are deployed from the launcher after Orbiter undocking from the ISS and are tracked using ground-based radar facilities. The requirements for MEPSI are in the MEPSI Payload Integration Plan, NSTS 21501 and annexes.

2. MAJOR MISSION OBJECTIVES

A combination of EVA, robotics, and IVA activities will be performed to accomplish the following major ULF1.1 mission objectives:

- a. Inspect all Orbiter Reinforced Carbon-Carbon (RCC) using the Orbiter Boom Sensor System (OBSS) attached to the SRMS, and downlink sensor data to the ground for evaluation.
- b. Inspect all Orbiter tile using ISS imagery during the rendezvous Rbar Pitch Maneuver (RPM) and the SRMS end effector camera.
- c. Perform two scheduled EVAs to accomplish DTO 849 objectives and install from the SHOSS-ED, the PM on the External Stowage Platform 2 (ESP 2) and two FGBs on the ISS.
- d. Transfer MPLM logistics and experiment hardware.
- e. Transfer middeck logistics and experiment hardware.
- f. Install the Spacehab Oceaneering Space System-Extended-height Deployable (SHOSS-ED), PM on the External Stowage Platform 2 (ESP 2)
- g. Remove and replace Rotary Joint Motor Controller (RJMC), and two FGBs on the ISS.
- h. Perform ISS crew augmentation (one up, zero down).

G. STATION DEVELOPMENT TEST OBJECTIVE (SDTO)

1. SDTO 12004-U: SHUTTLE BOOSTER FAN BYPASS

The purpose of this SDTO is to increase Shuttle on orbit cryo margin by bypassing and deactivating the Shuttle booster fan (airlock fan) whenever possible on-orbit. The booster fan will not be activated in post insertion and will remain deactivated for most of the mission. It will however be activated for APDS docking ring extension, docking, and undocking to provide cooling to the powered docking avionics and to prevent condensation on the ODS hatch window. The fan will also be activated when the crew is working in the airlock (such as during EMU checkout) to provide good airflow. While docked, sufficient air circulation will be achieved through use of the Lab forward IMV fan so that CO₂ levels on both the ISS and Shuttle can be controlled during the day by the ISS. During the overnight period, additional remediation may be required to control CO₂ levels in the Shuttle. A real-time call may instruct the crew to replace LiOH on the middeck to supplement the CO₂ removal provided by the ISS, or to reconfigure the duct and turn on the booster fan overnight. Acceptable flow rate through the IMV fan and proper CO₂ levels on the Shuttle throughout the docked timeframe must be confirmed on-orbit to prove this cryo reduction method a success.

H. ON-ORBIT DETAILED TEST OBJECTIVES (DTOs)

1. DTO 848: ORBITER THERMAL PROTECTION SYSTEM (TPS) REPAIR TECHNIQUES

The purpose of this DTO is to perform an on-orbit EVA demonstration of the tools and techniques developed to repair damaged Orbiter TPS tiles and RCC, however effective RCC repair techniques have not been developed to date. Tile samples will be mounted into the TPS Sample Box Assembly (SBA) and onto the upper surface of the LMC. The EVA crew will translate to the DTO worksite on the LMC, open the SBA protective cover, and use EVA tools such as the CIPAA and Emittance Wash Applicator to repair damaged tile samples. The SSRMS will be used to position EV crewmembers at the worksite. Tile repair objectives include: 1.) demonstrate adhesion of ablative repair material using various application techniques and repair depths, 2.) perform repairs to be evaluated post flight, 3.) demonstrate that tile repair can be accomplished without significant voids in the ablator material, 4.) demonstrate that recommended techniques are effective given environmental factors, and 5.) evaluate ablator material hardness after it has cured. RCC repair hardware and techniques may also be evaluated if viable methods are developed in time. MV/Orbiter Project Office is responsible for the design and development of this DTO.

2. DTO 849: OBSS/SRMS LOADS CHARACTERIZATION WITH EVA CREWMEMBER

The objective of the DTO is to characterize the loads and boom motion/deflection that are caused by an EV crewmember located at the end of the OBSS/SRMS. The measured EVA induced loads and boom tip deflections will be used to validate the 3 DOF Simulator, and to develop load-minimizing techniques, worksite stability requirements and associated hardware in order to accomplish EVA inspection and repair of the Thermal Protection System.

Loads data and deflection measurements will be made with an EVA crewmember simulating typical EVA operations that envelope the loads expected to be imparted on the system for all boom based operations. Data will be taken at several different SRMS positions to envelope the range of SRMS stiffness, from the weaker SRMS positions to the more sturdy positions. The EVA loads will be measured during all operations using EVA DTO hardware (Instrumented Worksite Interface - I-WIF), and the system dynamic response monitored and recorded.

3. DTO 850: WATER SPRAY BOILER COOLING WITH WATER/PGME ANTIFREEZE

The purpose of this DTO is confirm ground test results for Water Spray Boiler (WSB) capability post APU shutdown and confirm that coolant usage is within predictions. A special antifreeze of water and propylene glycol monomethyl ether (PGME) mixture will be loaded into WSB 3 only. All three APUs will be shut down per the nominal Post Insertion timeline and allowed to cool. Then APU 3 will be restarted in OPS 8 and allowed to heat until the WSB is commanded to spray. The APU 3 will be restarted while it is still warm but has not cooled below its normal restart limits, thus the restart will be a real-time call based on temperatures. APU 3 is projected to cool to the restart limits around MET 0/03:45 based on previous flight data. After cooling capability has been verified, APU 3 will be shut down again.

I. ON-ORBIT DETAILED SUPPLEMENTAL OBJECTIVES (DSOS)

1. DSO 490B: BIOAVAILABILITY AND PERFORMANCE EFFECTS OF PROMETHAZINE DURING SPACE FLIGHT

The purpose of this DSO is to evaluate Promethazine (PMZ) as an aide for space motion sickness. All participants will don an Actilight watch as soon as possible on orbit, and will record sleep times at wakeup. If motion sickness occurs during the first three days, participants will collect a saliva sample, take PMZ, and complete a series of saliva samples and logs.

2. DSO 493: MONITORING LATENT VIRUS REACTIVATION AND SHEDDING IN ASTRONAUTS

The objective of this DSO is to determine the frequency of induced reactivation of latent viruses, latent virus shedding, and clinical disease after exposure to the physical, physiological, and psychological stressors associated with space flight. Participants will collect a saliva sample and complete a log entry at wakeup.

3. DSO 633B: RENAL STONE RISK DURING SPACE FLIGHT, ASSESSMENT AND COUNTERMEASURE VALIDATION

The purpose of this DSO is to quantify the risk of renal stone formation associated with space flight, evaluate the effects of dietary intake on the urinary biochemistry, and determine the effects of potassium citrate as a countermeasure in reducing the potential for renal stone formation. Participants will ingest a potassium citrate (Kcit) pill with each evening meal.

4. DSO 634: SLEEP/WAKE ACTIGRAPHY AND LIGHT EXPOSURE DURING SPACE FLIGHT

The objective of this DSO is to monitor sleep-wake activity and light exposure patterns obtained in-flight, to better understand and develop countermeasures for insomnia common in space flight. Participants will don an Actilight watch as soon as possible on orbit, and will wear it continuously throughout the mission on their non-dominant wrists outside of their clothing/sleeve. A common Actilight watch is used for DSO 490B. Subjects will also complete a sleep log within 15 minutes of wakeup every morning.

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